REMARKS

Claims 1-11, 14 and 15 are pending in the application. Claims 1-11, 14 and 15 are rejected. Claims 6 and 8 are objected to but would be allowable if placed into independent form. Applicants have amended claims 1, 2, 6 and 8 and have canceled claims 14 and 15, because the limitations of the latter claims would be added to claims 1 and 6, respectively. Finally, new claim 16 has been added. The new claim is dependent from claim 1 and defines a feature that the discharge of the gas occurs "from the beginning of the moving step." In the prior art, the discharge of the gas never occurs from the beginning of the moving step. The basis of the feature is in paragraph 0041.

Specification

The Examiner objects to the specification, particularly claims 6 and 8, because the recitation of a "maximum height" in claim 6 is viewed as inconsistent with the amendment to claim 1. Also, the recitation of "closed space" in claim 8 is viewed as inconsistent with the amendment to claim 2.

As explained in the previous amendment filed on September 1, 2006, the variable "h" is the height of only a single space or the total height of both spaces, where two spaces exist. Claim 1 was amended to define the parameter "h" as the **total** height of the closed spaces. However, claim 6 was not correspondingly modified. Thus, Applicants have modified claim 6 to state that "a total height of closed spaces formed by the at least one of the upper mold and the lower mold in the direction of the moving of the movable mold is denoted as h micrometers."

Claim 2 also was modified to refer to "at least one of the upper mold and the lower mold which forms **a closed space** has a concave surface." A similar amendment has been made to claim 8.

Finally, Applicants have deleted reference to "T2" in claim 1 as it does not appear to have relevance to the claim set comprising claims 1-5 and 14 where there is no reference to a variable T1. This is in contrast to the claim set comprising claims 6-11 and 15, where variables T1 and T2 are recited.

Claim Rejections – 35 U.S.C. § 103

Claims 1 and 6 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Takagi et al (5,817,161) in view of Nomura (5,188,650) and Sato (4,591,373). This rejection is traversed for at least the following reasons.

The invention of the rejected independent claims 1 and 6 concerns a method of efficiently manufacturing optical glass elements by press-molding the glass material. The pressing mold comprises an upper mold and a lower mold, at least one being movable vertically and at least one having a shape such that the molding surface forms a closed space with a surface of glass material. The molding process involves a three-step pressing process in which the glass material is positioned between the molds in a first step, the molds are positioned to be in contact with the glass material in a second step. Then, the molds are continuously pressed in a single third step to produce the optical glass element. The three Examples at pages 18-30 follow these three steps, accompanied by heating of the glass material to certain specified temperatures.

The claimed method comprises the steps of applying the glass material between the upper mold and the lower mold, and moving at least one of the upper mold and lower mold at an

average moving rate of less than or equal to 10 mm/min at least for a distance h micrometers after the glass material becomes in contact with the upper mold and the lower mold. In both of claims 1 and 6, the temperature of the pressing mold is at a predetermined temperature within a range in which the glass material exhibits a viscosity of from $10^{7.4}$ to $10^{10.5}$ poises.

Claim 1 further includes the steps of supplying the glass material at a temperature of less than a temperature at which the glass material exhibits a viscosity of 10^{11} poises and heating the supplied glass material by thermal conduction by means of contact with the upper mold or lower mold on the side on which the space is formed.

Claim 6 further specifies the step of moving is conducted when a temperature of the outer surface of the supplied glass material is higher than the interior of the glass material and the outer surface is at a predetermined temperature T1 within a range in which the glass material exhibits a viscosity of from $10^{7.4}$ to $10^{10.5}$ poises.

Notably, both claims 1 and 6 now specify moving of the movable mold for a distance h such that "a total height of the closed spaces formed by the at least one of the upper mold and the lower mold in the direction of the moving of the movable mold is denoted as h micrometers." Further, both claims states (1) that the pressing step is a single continuous pressing operation and (2) that causes discharge of the gas from the closed space.

Takagi et al

The Examiner looks to Takagi et al. for disclosure of a method for manufacturing optical elements as previously analyzed in our reporting letter of June 3, 2006. Further, Takagi is expressly limited to the production of a lens by pressing a blank using "alternately repeated

operations of pressurizing the upper die and stopping the application of pressure thereto" so that trapped gas can escape.

As to claim 1, the Examiner again admits at page 3 of the Office Action that Takagi et al. fails to teach supplying heated glass material and again admits at page 4 of the Office Action that Takagi et al fails to teach a moving rate of the mold while pressing.

As to claim 6, the Examiner admits at page 4 of the Office Action that Takagi et al fails to teach a temperature difference between an outer surface and interior of the glass material. Nonetheless, the Examiner observes that one skilled in the art would expect the outer surface of the glass material to be higher that the interior of the glass material when at a temperature in which the glass material exhibits a viscosity of $10^{10.2}$ poise since it is the outer surface that is in contact with the heat source.

The Examiner looks to Nomura and Sato for the missing teachings.

Multi-pressing

However, before addressing Nomura and Sato, it is important to note that Takagi et al is a multi-pressing method (six pressings in the preferred embodiment at cols. 5 and 6) where there are multiple stops and starts in the pressing operation due to the need to compensate for trapped gasses and avoid damage to the glass element. This approach is highly inefficient and there is no teaching or suggestion as to how the number of steps may be reduced. Moreover, the repeated operations cause adherence of the glass material with the molding surface and imprecise transfer of the shape of the molding surface to the glass material.

Gas Discharge

Applicants respectfully refer to column 5, line 50 to column 6, line 14 of Takagi reference, especially, in column 5, line 61 to column 6, line 1, where there is the following teaching:

> *As above-mentioned, however, the high gas pressure in the closed space 3b which had been increased to about 3.9 kgf/cm², loosened the state of close contact between the upper die 3 and the periphery of the optical element blank 1 to locally form a non-contact part therebetween. This served as the gas passage 3d, through which the gas caught in the closed space 3b was momentarily discharged outside.*

However, the above discharge occurs when **bringing the pressurizing force to zero** (see column 5, lines 56 to 61).

In contrast, during the pressurizing operation, the upper die 3 always came in contact with the periphery of one end surface of the blank I. Accordingly, the gas caught in the closed space 3b could not escape to the outside. (see column 5, lines 50 to 53).

Thus, it is clear that Takagi reference fails to teach "discharge of the gas from the space by movement of the mold." To make this distinction clear, Applicants have incorporated the limitation of "discharge of the gas from the closed space" into the moving step of claim 1.

Nomura

At page 3 of the Office Action, the Examiner asserts with respect to claim 1 that Nomura teaches a vertically slidable mold used for pressing optical elements, as disclosed at col. 2, lines 48-52 where glass material is supplied at a temperature less than a temperature at which the glass material exhibits a viscosity of 10^{11} poises as disclosed at col. 4, lines 31-36.

At page 4 with respect to claim 6 the Examiner states that Nomura teaches the expected temperature difference between the outer surface and interior of a glass material when placed into a mold for pressing, at col. 2, lines 67 to col. 3, line 3. The Examiner asserts that one skilled in the art would have expected a higher outside surface temperature at the beginning of the pressing step of Takagi as suggested by Nomura.

Again Applicants respectfully submit that this reference is only cited for a molding process for a spherical glass blank by pre-heating the blank to a temperature within a variety of ranges and pressing at specified pressures, such as the pressure of 10-100 kg/cm^2 for a temperature range of 10^{12-11} poises, the pressure of 10 x (10^{11-x}) - 100 +10 x (10^{11-x}) kg/cm^2 for a temperature range 10^{11}-10^{10} poises, and a pressure of 100 kg/cm^2 for a viscosity of 10^{10} or less in terms of glass viscosity (see Abstract). <u>There is no consideration of the problem of trapped gasses or of reducing the number of steps confronted by Takagi et al due to trapped gas</u>. Thus, there is no basis for assuming that the combination of Takagi et al with Nomura would even work, let alone lead to the present invention. Even though Nomura generally suggests a "continuous process" as noted by the Examiner at page 9 of the Office Action, this is not a <u>process with the steps as recited in the present claims</u> with a goal of solving the problems confronted by the Applicants, namely overcoming the problem with trapped gas to produce a quality optical element in a single continuous pressing. Further, there is no teaching that the pressing <u>causes discharge of the gas from the closed space.</u>

<u>Sato</u>

At page 4 of the Office Action, the Examiner points to Sato for a teaching of "several variables to consider while pressing optical elements with the desired surface accuracy, including

the moving speed of the mold of 0.5-2 um/sec (0.12 mm/min) at col. 1, lines 33-63)." Indeed, Sato at col. 1, lines 33-63 identifies several generally known considerations in press molding optical glass elements and specifically notes at lines 56-63 that accuracy in controlling of the moving speed in the final stage of molding and the distance of displacement greatly affects the accuracy of the optical element.

The Examiner asserts that press molding speed of Sato would have been used in Takagi et al to better control the accuracy of the optical element when molding.

However, Sato et al does not teach how or why the specific steps set forth in the present invention should be used. Sato provides nothing more than a generalized list of desirable parameters, without application to a specific manufacturing process. More importantly, Sato does not teach how the multi-step process of Takagi et al can be converted to a continuous process as set forth in claims 1-6. Notably, as clearly stated in the Background of the present invention, multiple repeated steps are to be avoided by the present invention. The present invention is derived in order to permit the discharge of gas without the need for grooves, notches or center holes, and without the need to generate a vacuum during press molding. Further, repeated pressing and releasing, which is highly inefficient, is not required as already noted.

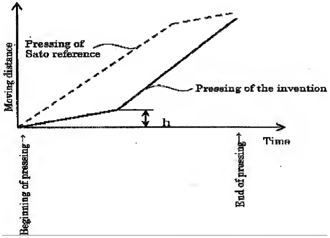
Again, Applicants respectfully submit that the molding of glass materials is highly dependent upon a wide variety of factors including temperature, pressure and glass composition. Issues concerning cracking, stressing, crazing and sticking are all of concern when developing the sequence of steps used for high yield production of accurate glass lens products. The present invention defines processes that achieve these goals. Nothing in the references teaches or suggests such processes. Moreover, nothing in the references teaches or suggests their

combination to achieve the present invention. To the extent that the Examiner may join together bits and pieces from different references, there has been an impermissible use of hindsight.

At page 9 of the Office Action, the Examiner simply notes that the features relied upon in Applicants' argument (i.e., pressing in a single step) are not recited in the rejected claims. <u>The claims now recite a single and continuous pressing step where gas escapes during the pressing process</u>. The discharge of the gas from the closed space in the moving step of claim 1 can be established by combination of the specific moving rate and the specific glass material viscosity. The recited process is a significant improvement over the prior art.

In a conventional press molding, a mold moves after exceeding the distance "h" to mold a glass material to obtain an optical glass element. If the total moving distance is 10, the distance "h" is about 2-3. A mold is moved at a rate quicker than the "10mm/min or less" in order to reduce processing time after exceeding the distance. Thus, the mold moves at least a distance h micrometers after the glass material becomes in contact with the upper mold and the lower mold

This mode is depicted in the following graph. In the graph, change in moving rate of a mold in the process of Sato reference and that of the present invention are shown.



The slope of the graph means a pressing rate, distance/time, and .smaller slope means slower rate.

Sato teaches movement of mold at a rate of 10mm/min or less but this movement is conducted at the later stage (see above graph) and with this movement, it is difficult to discharge the gas in the closed space formed between a perform and a lower mold in the mold.

As asserted by the Examiner, Sato teaches that the moving speed of the mold in the final stage of molding of the glass piece is, in the case of normal optical lenses, 0.5-2 micrometers per second in the fastest ease and the distance of displacement is several micrometers to several tens micrometers m terms of the entire moving distance. (Column 1, lines 56-61)

However, an object of Sato's invention is to provide a novel method capable of accurately controlling the moving speed and distance of displacement of the mold among the above described various factors to be considered. In one aspect of the Sato invention, there is also provided a method for accurately controlling the timing of stopping a movement of the mold in the molding step. (Column 1, line 64 - Column 2, line 2)

Thus the pressing rate profile of Sato is as shown in the above graph and the object to selection of a certain pressing rate in Sato is totally different from the present invention.

As regards additional differences from Sato reference, Applicants respectfully submit that there is a difference in viscosity of a glass material to be press molded with an upper mold and a lower mold at moving step as well. As seen from Table 1 (at the bottom of column 6) of Sato reference, a glass material to be press molded in Example 1 exhibits $10^{6.7}$ poises and a glass

material to be press molded in Example 2 exhibits $10^{6.8}$ poises at the beginning of pressing. In contrast, the glass material in the moving step exhibits a viscosity of $10^{7.4}$ to $10^{10.5}$ poises. Thus the viscosities of the glass materials to be molded at the beginning of pressing in moving step are different each other.

In addition, Table 1 shows surface temperature at stopping of mold movement (see column 7), $673 \pm 4 C^{\circ}$ in Example 1 and $409 \pm 5 C^{\circ}$ in Example 2 and these temperature are level lower than the strain point of the glass material ($10^{14.5}$ poises). Thus, the viscosity of the glass material at the later stage of the pressing step at a moving rate of 0.5 to 2 micrometers is assumed to be about $10^{14.5}$ poises and this is out of the range of the present invention, $10^{7.4}$ to $10^{10.5}$ poises.

This means that the combination of Takagi and Sato never teach the present invention.

Applicants respectfully submit that the rejection has been overcome and the claims should be found to be patentable.

Claim 7 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Takagi et al (5,817,161) in view of Nomura (5,188,650) and Sato (4,591,373), and further in view of Marechal et al (4,481,023) or Hirota et al (6,918267). This rejection is traversed for at least the following reasons.

Claim 7 depends from claim 6 and would be patentable for the reasons already given. The claim further concerns the step of heating the glass material so that the <u>outer surface</u> of the glass material reaches a temperature T1 in which the glass material exhibits a viscosity of from $10^{7.4}$ to $10^{10.5}$ poises <u>prior to</u> supplying the glass material between the upper mold and the lower mold. The Examiner admits that neither of Nomura and Takagi (and presumably Sato) teaches

supplying glass at a temperature with a corresponding viscosity in the range of $10^{7.4}$ to $10^{10.5}$ poises.

Marechal et al

The Examiner again looks to Marechal et al. for such teaching, particularly at col. 3, lines 57-60, 63-64 and col. 4, lines 54-56. The Examiner concludes it would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the heated glass at Marechal et al. and the processes of Takagi et al., Nomura and Sato in order to reduce mold processing time.

Applicants argued that there is nothing in Marechal et al. that would lead one of ordinary skill in the art to combine the references to Takagi et al., Nomura and Sato. Applicants also argued that there is nothing that would lead one of ordinary skill in the art to preheat the glass material in Takagi et al., as the reference is concerned with multiple pressing and release steps and would not be concerned with the reduction in processing time, as suggested by the Examiner. Applicants argued that, even if such concern existed, there is no teaching or suggestion as to why the heating of the outer surface of the glass material prior to supplying the glass material to the molds, would be desirable. Finally, Applicants argued that the only teachings in Marechal et al. concern heating of the entire glass preform, and does not concern heating the outside surface to a predetermined temperature.

At page 9 (paragraph 12) of the Office Action, the Examiner admits that Takagi et al does disclose multiple pressing process, but asserts that this does not indicate a lack of concern with reducing processing time in other steps. The Examiner also asserts that one skilled in the art would expect heating of the outer surface of glass to involve overall heating of the glass, such that overall heating would result in an outer surface with the recited viscosity.

With respect to the Examiner's first point, Applicants would disagree, and would assert that the affirmative teachings of Takagi et al are directed to a multi-step process with no hint or suggestion for reducing the number of steps. Takagi et al is concerned with gas evacuation and there is nothing in any other reference that would solve the problem and reduce the number of steps.

With respect to the second point, Applicants would assert that Marechal et al does not teach or suggest that the heating should be uniform from the outer surface to the inner core of the optical element. Moreover, Applicants would assert that Marechal et al teaches a preference for a multi step pressing process using one pair or two pairs of molds, rather than a single continuous pressing operation using one mold pair, due to the extended time required (see col. 10, lines 42-66).

Hirota et al

With respect to Hirota et al, the Examiner again asserts that it discloses the preheating of glass material to a temperature in which the glass material exhibits a viscosity of 10^{8} poise (col. 10, lines 50-66) and asserts that it would have been obvious to utilize the preheating step of Hirota et al in the processes of Takagi et al, Nomura and Sato in order to promote surface accuracy as taught by Hirota et al.

The Examiner is simply taking parameters for different processes and mixing them together without any appreciation for the overall goals and available technologies and materials employed. This is an improper use of hindsight. If there are technical reasons why the combination would not be made, please advise in your instruction letter. In any event, Applicants would assert that the claim would be patentable over the cited art.

Claims 2 and 8 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Takagi et al (5,817,161) in view of Nomura (5,188,650), Sato (4,591,373) and Marechal et al (4,481,023) or Hirota et al (6,918267), and further in view of Kataoka et al (5,904,747). This rejection is traversed for at least the following reasons.

Applicants argued that these claims would be patentable for reasons given with regard to their parent claims and that nothing in the added reference to Kataoka et al. would remedy the deficiencies of the other four cited references, as already explained.

Kataoka et al

The Examiner admits that the other references do not mention a radius of curvature. Kataoka et al. is cited for teaching of a mold with a concave surface with a radius of curvature R1 that is smaller than the radius of curvature of the glass material, which has a convex surface, which forms a closed space with a mold, as shown in Fig. 7. Applicants argued that nothing in the reference would teach or suggest the combination of steps and limitations as set forth in the rejected claims 2 and 8.

At page 9 of the Office Action (paragraph 13), the Examiner replies that Kataoka et al is cited for its disclosure of "an alternative and more efficient solution to removing surface deformations on the optical element."

Claims 3, 4, 9 and 10 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Takagi et al (5,817,161) in view of Nomura (5,188,650), Sato (4,591,373), Marechal et al (4,481,023) and Hirota et al (6,918267). This rejection is traversed for at least the following reasons.

Claims 3 and 9 call for a pressure to be increased on or after the time that the moving distance of the mold reaches a distance h micrometers. This feature is taught at page 15 of the specification. Claims 4 and 10 further define the increased pressure of parent claims 3 and 9, respectively.

Claims 3, 4, 9 and 10 would be patentable for reasons already given with regard to their parent claims 2 and 7. Moreover, there is no teaching or suggestion in any of the reference for increasing the pressure after a distance h has been traveled.

Takagi et al

Applicants previously argued that in Takagi et al, the pressure is reduced during the cycling of pressure, rather than increased. The Examiner responds at page 9 of the Office Action (Paragraph 14) that Takagi et al uses a constant pressure during the pressing stages. However, the parent claim now states that there is a single and continuous pressing step that causes discharge of the gas from the closed space. This would distinguish over Takagi et al

Nomura

Applicants previously argued that, according to the flowcharts of Figs 7A and 7B in Nomura, this is not a single pressing step, as taught in the present invention. The Examiner responds at page 9 of the Office Action that Nomura et al does disclose a single continuous pressing step that causes discharge of the gas from the closed space. Applicants submit that the deficiencies of the rejection with respect to the parent claims, including the discharge of gas, are not remedied by Nomura, as already argued.

Claims 5 and 11 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Takagi et al (5,817,161) in view of Nomura (5,188,650), Sato (4,591,373) Marechal et al

(4,481,023) and Hirota et al (6,918267). This rejection is traversed for at least the following reasons.

These claims would be patentable for reasons given with regard to their parent claims 4 and 10.

Takagi et al

Previously, in response to the Examiner's statement that the two-step process of Takagi et al. indicates an increase in the moving rate of the mold "from zero to moving" after the mold has moved the distance h, Applicants stated that this analysis involves a distortion of the clear meaning of the claim. The comment is based on the indefiniteness of the Examiner's original comment.

The Examiner responds that this is a general allegation unrelated to the language of the claim and the teachings of the prior art.

Applicants would rely on the limitations in the parent claims related to a single continuous pressing that causes discharge of the gas from the closed space, which is not shown in the prior art, as already discussed.

Claims 14 and 15 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Takagi et al (5,817,161) in view of Nomura (5,188,650) and Sato (4,591,373), as applied to claims 1 and 6, and further in view of Kataoka et al (5,904,747). This rejection is rendered moot by the cancellation of the claims and their incorporation into claims 1 and 6, respectively. However the following comments are applicable to the cited art as applied to amended claims 1 and 6.

Takagi et al

The Examiner asserts that Takagi et al disclose a press molding process comprising several pressing stages in order to prevent surface deformations on the optical element due to the buildup pressure in the closed spaces. The Examiner admits that Takagi et al fail to disclose a single pressing of the glass material. Similarly, there is no continuous pressing that causes discharge of the gas from the closed space.

Kataoka et al

The Examiner asserts that Kataoka et al present a solution to preventing the surface deformation on the optically functional area of the optical element by using a glass material with a radius of curvature larger than the radius of curvature of the molding surface, thus eliminating multiple pressing stages. The Examiner points to closed spaces with the upper and lower molds and a single pressing in Fig. 3, col. 4, lines 19-21 and asserts that it would have been obvious to use such single step in Takagi et al. to have a more efficient press molding process.

Applicants respectfully submit that the purpose of the disclosure in Kataoka et al is to test the lifetime of the molds and not to produce quality lenses. Even though testing on the lenses for deformities was made, this is not a teaching relevant to the modification of Takagi et al. Thus, the combination of references fails to teach the subject matter of claims 1 and 6.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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